

III. Sexual Selection

Behavioral (morphological) traits that can be explained
by intra-specific competition

Darwin (1871): involves “ a struggle between the individuals of one sex, generally the males, for the possession of the other sex”.

Sexual Selection: 2 forms

1. Intersexual selection
(or mate choice)
2. Intrasexual selection
(male-male competition)

Male-male competition

1. Red deers compete for females



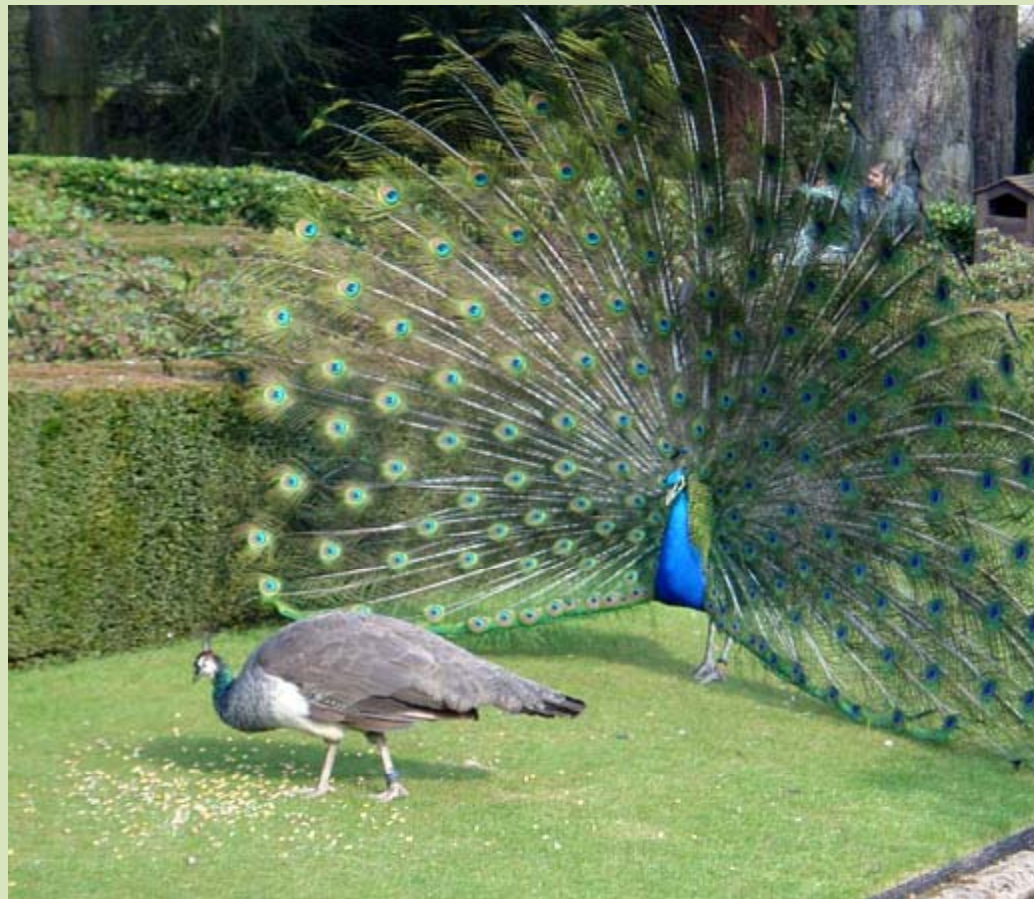
Male-male competition

1. Elephant seals defend territory and dominance



Sexual selection by mate choice

1. Peacock's tail feathers and display



Sexual selection by mate choice

2. Dancing courtship



Sexual selection by mate choice

2. Song repertoire



Great reed warbler

Female warblers choose a territorial male who has a larger repertoire size.

Sexual selection by mate choice

2. Male **volgel** bowerbirds build bowers



Sexual selection by mate choice

1. Male **satin** bowerbirds build bowers



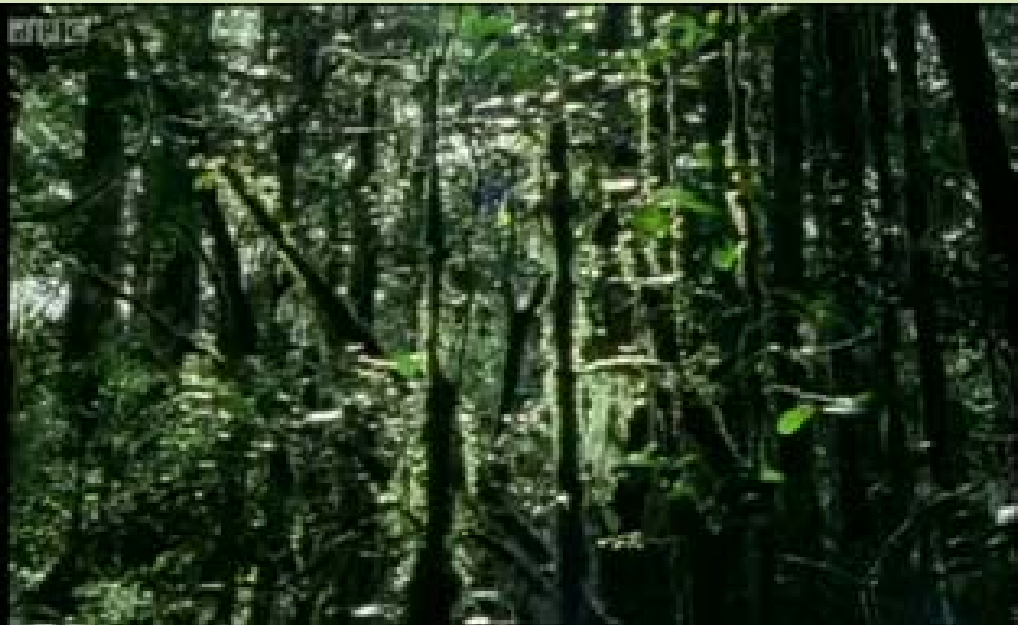
Sexual selection by mate choice

1. Male birds of paradise's plumage and display



Sexual selection for mate choice

1. Male birds of paradise's courtship behavior



Sex differences:

1. In general, why females choose, why males evolve secondary sexual characters?
2. Fundamental difference is the gamete size.
Females produce fewer, larger gametes (eggs), each egg is costly, more valuable to produce.
Males produce more, smaller gametes (sperms) sperms are cheap to produce.
3. Males tend to acquire as many mates as possible, Females tend to be choosier.

Evolution of sexually selective traits:

In general, why females choose, why males
evolve secondary sexual characters?

Evaluate cost and benefit!

Evolutionary models of mate choice

why females choose?

- 1. Direct benefit hypothesis
- 2. Good gene hypothesis
- 3. Runaway hypothesis
- 4. Sensory exploitation hypothesis

Evolutionary models of mate choice

why (what) female choose?

- 1. Direct benefit hypothesis

choose males (mates) provide them with
resources: food, territory (home), assistance
in parental care....

1. Direct benefit hypothesis



Female scorpionflies choose males that bring large prey items—food

1. Males with no food → rejected!
2. Males with food:
females control the copulation time based on the size of prey!
(why copulation time matters?)
3. What benefit females have by doing so?
4. Evolution of male's strategy?

Evolutionary models of mate choice why (what) females choose?

- 1. Direct benefit hypothesis
- 2. Good gene hypothesis
- 3. Runaway hypothesis
- 4. Sensory exploitation hypothesis

2. Good gene hypothesis

- Females are favored to choose mates (and their sperms) that possess “good gene”. –indirect benefit
- Good genes coded for favorable traits – plumage, song repertoire, capability to defend territory
- “Good gene” trait is an honest indicator of male genetic quality – costly to produce.

I love you!



Not an honest indicator

Honest trait is “good gene”



Peacock's tail is a honest signal of the male's genetic quality

Choose this male will
Increase a female's
reproductive success

The costlier the trait, the more difficult it is to fake

Honest trait is “good gene”



Peacock's tail is a honest signal of the male's genetic quality

Parasite resistance

Healthy males



More colorful



Less parasites



Good gene

Good gene hypothesis and MHC gene

MHC-dependent mate preferences in humans

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SUMMARY

One substantial benefit of sexual reproduction could be that it allows animals (including humans) to react rapidly to a continuously changing environmental selection pressure such as coevolving parasites. This counteraction would be most efficient if the females were able to provide their progeny with certain allele combinations for loci which may be crucial in the parasite-host arms race, for example the MHC (major histocompatibility complex). Here we show that the MHC influences both body odours and body odour preferences in humans, and that the women's preferences depend on their hormonal status. Female and male students were typed for their HLA-A, -B and -DR. Each male student wore a T-shirt for two consecutive nights. The next day, each female student was asked to rate the odours of six T-shirts. They scored male body odours as more pleasant when they differed from the men in their MHC than when they were more similar. This difference in odour assessment was reversed when the women rating the odours were taking oral contraceptives. Furthermore, the odours of MHC-dissimilar men remind the test women more often of their own actual or former mates than do the odours of MHC-similar men. This suggests that the MHC or linked genes influence human mate choice today.

Good gene hypothesis and MHC gene

MHC gene (Major Histocompatibility Complex):
involves in disease resistance in many animals



Animals prefer mating with others with dissimilar MHC



Offspring with better immune resistance to diseases.

Females use odors to identify males with dissimilar MHC– “sexier”

Good gene hypothesis and tail **symmetry** in barn swallows



Symmetry as a honest signal of a male's health?

Assume: mating with symmetry males → symmetry young

Good gene hypothesis and facial symmetry



FACIAL SYMMETRY



Symmetry as a honest signal of mate's health?

Evolutionary models of mate choice why (what) females choose?

- 1. Direct benefit hypothesis
- 2. Good gene hypothesis
- 3. Runaway hypothesis
- 4. Sensory exploitation hypothesis

Runaway hypothesis



widowbird

Need to have 2 sets of genes

One gene is coded for female preference of longer tail.



The other gene is coded for developing male's longer tail.



Females choose longer and longer tails;
Males evolve longer and longer tails.



Runaway process

* Females gain no direct or indirect benefit by choosing a male.

Evolutionary models of mate choice why (what) females choose?

- 1. Direct benefit hypothesis
- 2. Good gene hypothesis
- 3. Runaway hypothesis
- 4. Sensory exploitation hypothesis

Sensory bias model

1. Females bluebirds prefer red berries; increase survival/reproduction.
2. Females evolved sensory bias toward red color.
3. Male bluebirds who have red colored will be chosen and evolved.
4. Eventually, all the males bluebirds evolve red plumage.

Males offer no direct or indirect benefit to females



Evolutionary models of mate choice why (what) females choose?

- 1. Direct benefit hypothesis
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Quiz: What female choice model?

1. Male birds of paradise's plumage and display



Quiz: What female choice models?

2. Song repertoire



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Male-male competition

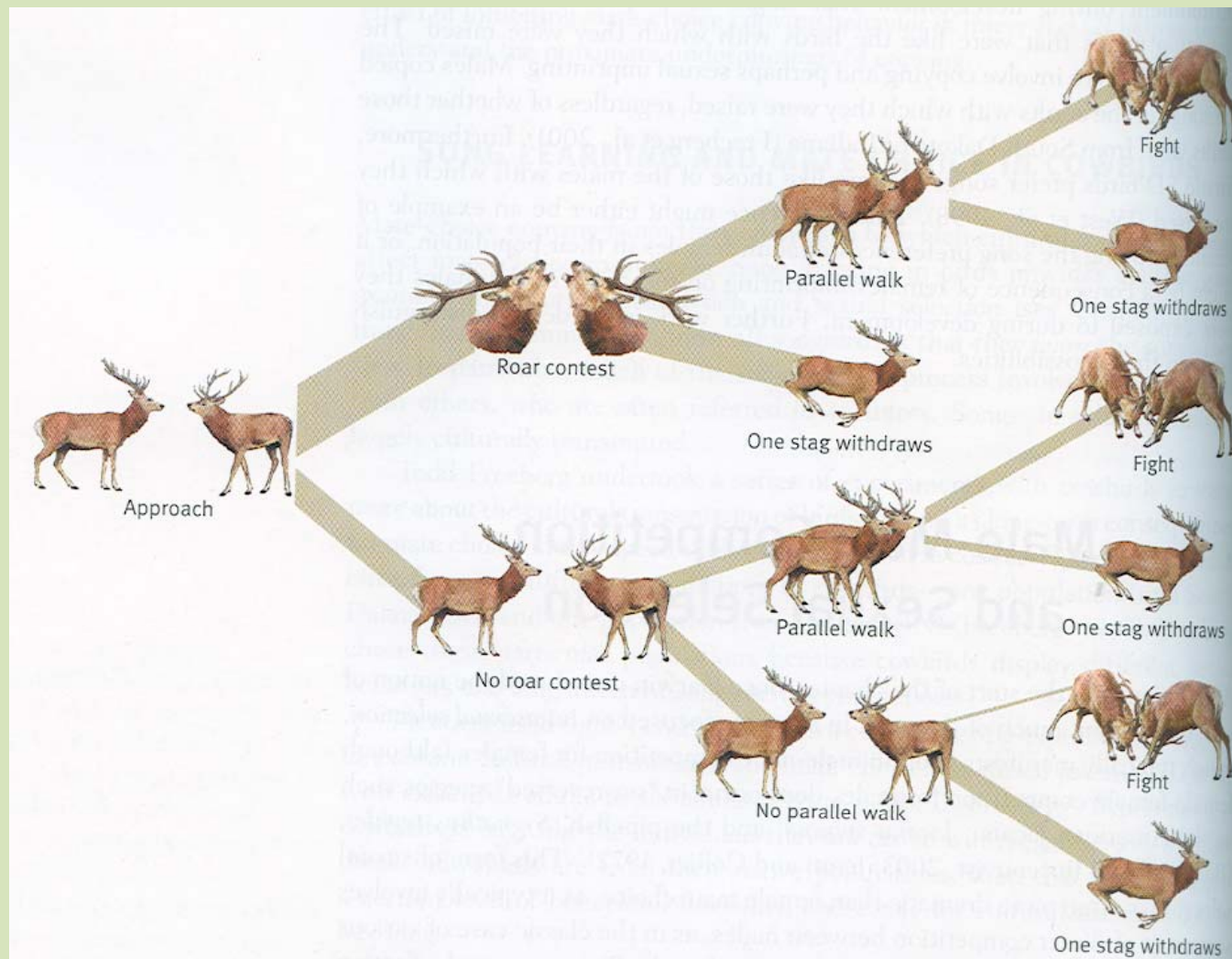
1. Male red deers compete for female herd,
but fighting has a big cost...



1. Evaluate each other
* Honest indicator!
2. Roaring contest
(honest signal?)
3. Fight

Male-male competition

1. Male red deer's strategies for competition



Fight or not?

Strategies for male-male competition

* Bluegill sunfish



Three male morphs:

1. Parental male (aggressive, bigger)
2. Sneaker male : “hit and run” strategy
3. Satellite male: looks like females

Strategies for male-male competition

* Bluegill sunfish



| | Sperm quantity | Sperm quality | Sperm life |
|---------------|----------------|---------------|------------|
| Parental male | fewer | higher | longer |
| Sneaker male | more | lower | shorter |

Strategies for male-male competition

Elephant seals: males compete for female harem



1. Dominant males
2. Subordinate males
3. Female interference

Male–male competition

Alternative mating strategies for subordinate males

1. Develop friendship with the female (potential mate)
2. Develop friendship with other subordinates
3. Sneaker (when dominant males are not around)
4. Satellite behavior (female-mimicking)
5. Force-copulation

Consequence of sexual selection

---- Sexual dimorphism

Harem size increases



Male-male competition
more intense



Sexual dimorphism

Evolution of sexual dimorphism



Harbor seals: Each male mates with a few females

“Monogamous” – less sexual dimorphism



Elephant seals: Dominant male mates with > 100 females

“Polygynous” — more sexual dimorphism

Evolution of sexual dimorphism



Monogamous birds:

less sexual dimorphism



Polygamous birds:

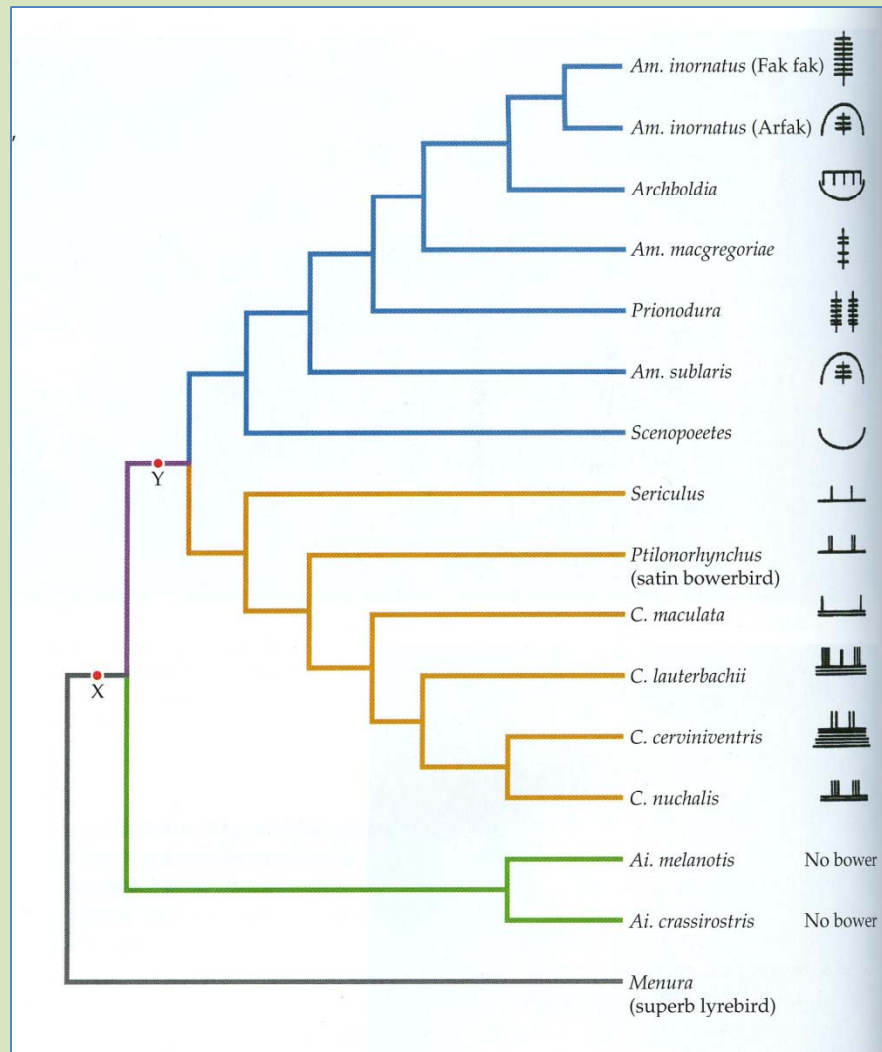
More sexual dimorphism

The origin of sexually selected traits



How does bower-building originate?

The origin of sexually selected traits



Phylogeny tree
of bowerbird family
(mitochondria DNA)

How does bower-building originate?